

Assessing Endocrine-Disrupting Chemical Exposure in Indigenous Aquatic Populations in the Ohio River

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The NERL has launched a collaborative study with the ORSANCO to determine the degree of ecologically relevant endocrine-disrupting chemical (EDC) exposure in the New Cumberland Pool of the Ohio River under the Environmental Monitoring and Assessment Program - Great Rivers Project (EMAP-GRE). EDCs are common to oral contraceptives and are often present at relatively high levels in sewage effluents from metropolitan areas as well as runoffs from cattle farms. There are increasing examples of male fish displaying female sex characteristics in the waterways of the United States and Europe. EDCs have been shown to affect multiple aspects of fish biology including fecundity, mortality, and development. These biological endpoints require large-scale morphological or behavioral changes and constant long-term exposure. Therefore, before these indicators are manifest at measurable levels, indigenous populations have already undergone significant environmental stress. In contrast, changes in gene expression are often the initial and direct response of biological systems to EDCs and other environmentally relevant toxicants and are measurable at exceedingly low levels. Gene expression is becoming a commonly used diagnostic tool in human health for cancer research and is now gaining acceptance in the ecological world. The most well established genetic indicator of EDC exposure in aquatic systems is the egg precursor protein vitellogenin (Vg), expressed in reproductive females and quiescent in males. The NERL Cincinnati recently established a sensitive experimental system capable of reproducibly measuring changes in Vg mRNA abundance in response to a variety of estrogenic, hormonal EDCs. To field-test our experimental system, ORSANCO will collect samples of two indigenous fish species, the smallmouth bass and the smallmouth buffalo. This project will validate the ecological relevance of aberrant male Vg expression in wild populations by integrating other more established indicators of ecological disruption also surveyed under the EMAP Great Rivers Project. We will critically evaluate indicators of ecological disturbances at different spatial scales ranging from the individual through the landscape level to determine the most appropriate indices of environmental health. Finally, we will gain important information as to the extent of EDC exposure in aquatic ecosystems of the New Cumberland Pool of the Ohio River.

Although this work was reviewed by the U.S. Environmental Protection Agency and approved for publication, it may not necessarily reflect official Agency policy.